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THE VERTICAL SEED-COTTON DRIER

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NEED FOR COTTON DRIERS

Many plantations lack facilities for storing their entire cotton crop or drying it artificially. Usually the first pickings require drying on account of the sticky condition of the cotton, while much of the late-picked cotton is rain soaked. Any successful drying process must make it possible to handle freshly harvested cotton, whether from the early crop or from the final pickings of the season.

The average battery of 4-80 saw gins handles about 100 pounds of seed cotton per minute, and the process and equipment described in this leaflet have been worked out to provide a simple and dependable installation which will dry sufficient seed cotton at a continuous rate to prevent interruptions in ginning caused by wide variations of weather and of moisture conditions in the cotton. Capacity ample to supply a commercial 5-80 gin is also feasible.

THE GOVERNMENT PROCESS

The Bureau of Agricultural Engineering has developed and patented a process for drying seed cotton that has come to be known as "the Government process," and may be used with several types of apparatus. This process involves the following features: (1) The damp seed cotton is treated with a continuous current of hot air, at the rate of from 40 to 100 cubic feet of hot air for each pound of damp seed cotton; (2) the damp seed cotton is exposed to the drying process for different periods, usually from 45 seconds to 3 minutes; (3) the temperature of the drying air should preferably be between 160° and 200° F. for cotton handled during the early

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part of the ginning season, but temperatures as high as 225° have been used satisfactorily with late-season wet cotton. Tests have indicated that these temperatures have no unfavorable effect on the planting quality of the cottonseed.

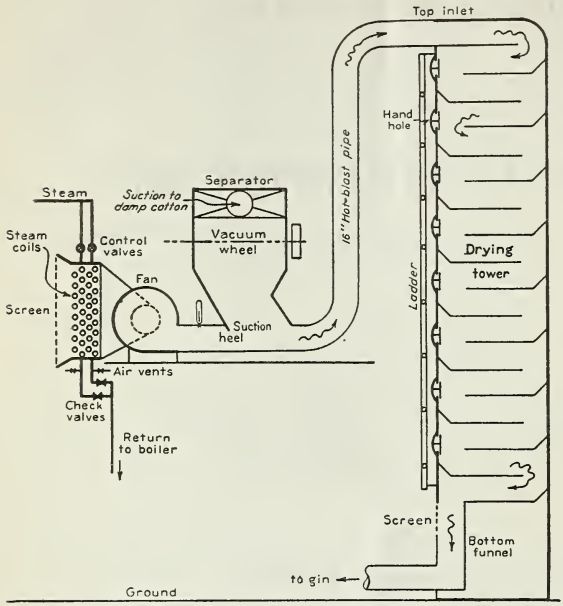

FIGURE 1.—Section diagram of vertical drier with 17 floors

Equipment required by this process includes a suitable drying cabinet or tower, a vacuum-wheel type of separator, two fans (generally), means for heating air, and the necessary cotton piping.

CHARACTERISTICS OF VERTICAL DRIER

The vertical drier described in this publication has no moving parts within the drying chamber and will readily dry cotton that does not contain an extraordinary amount of moisture. Very damp cotton may be dried by passing it through the drier a second time. The device may be operated in any kind of weather, provided the dried cotton is conveyed from the drier directly to the gins in the heated air.

The space required for the drier is not too great to permit installing the equipment in connection with cotton gins of standard widths and heights. The tower may be placed either within the gin building or out of doors, as its construction is suitable for either location, but the steam coils, fans, and feeding equipment always are sheltered within the gin building so that they may be accessible to the ginner at all times.

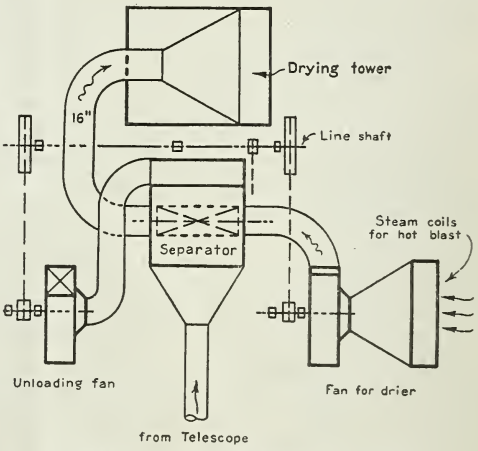

FIGURE 2.—Plan diagram of vertical drier

The general plan of the drier and the manner in which it is connected to the gin are shown diagrammatically in Figures 1, 2, and 3. The following pages give details and descriptions of construction

which make it possible to construct the drier with the class of labor ordinarily available about cotton gins or plantations. An approximate bill of materials is given in Table 1.

TABLE 1.—*Approximate bill of material for a 17-floor vertical seed-cotton drier*

Description	Use	Quantity
2-row sections 30 by 48 inches, fin-type steam coils	To heat the air	2
30-horsepower vertical boiler	To supply steam	1
Standard vacuum-wheel separator	To feed drier	1
No. 35 gin fan	Damp cotton unloader	1
No. 40 or 45 gin fan	Hot blast	1
Cotton piping, 16-inch and smaller	See drawings	(1)
Steam pipe, valves, etc	do	(1)
Sheet-metal chute from separator to blast pipe	do	1
Sheet-metal top inlet	On top of tower	1
Sheet-metal bottom funnel	At bottom of tower	1
Fine intake screen	At steam coils	1
Heavy outlet screen, ½-inch mesh	At bottom of tower	1
2 by 6 inch by 14 foot yellow pine lumber	Corner posts of tower	24
2 by 8 inch by 14 foot yellow pine (to be cut)	Sides of tower	40
2 by 8 inch by 16 foot yellow pine (to be cut)	Front and back of tower	22
2 by 8 inch by 10 foot yellow pine (to be cut)	Top of tower	4
2 by 4 inch by 12 foot yellow pine (to be cut)	Ladder, etc	6
No. 28 galvanized plates, 48 by 96 inches	Front and back lining of tower	6
No. 28 galvanized plates 48 by 72 inches	Lining sides of tower	12
No. 22 galvanized plates 48 by 60 inches	Tower floors	17
½ by 7 inches carriage bolts and washers	Handholes in tower	16
2 by 4 inch by 4 foot yellow pine lumber	Floor supports	68
2 by 4 inch by 1 foot yellow pine lumber	Incline supports	34
16-penny common nails		1 keg.
8-penny common nails		1 keg.

[1] As required.

CONSTRUCTION OF THE VERTICAL DRIER

TOWER

Within the tower are 13 to 20 stationary, sheet-metal floors, carried upon 2 by 4 inch skeleton frames. (Fig. 4.) For use in the Mississippi River States and North Carolina, 17 floors or more are

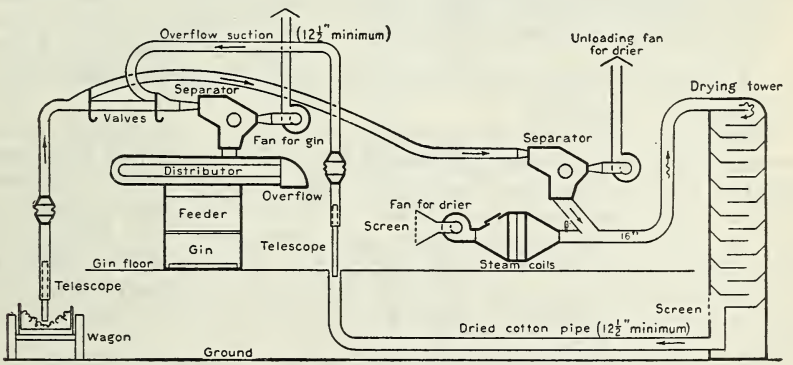

FIGURE 3.—Suggested layout for gin and vertical drier

recommended. In Georgia, Alabama, Oklahoma, and southern Texas, 13 to 15 floors may suffice. Where heavy fogs are prevalent, 19 or 20 floors may be advisable. Two floors more than the minimum necessary add but little to the cost. With an odd number of

floors both top-inlet and bottom-outlet piping connections will be on the front of the drier; with an even number of floors the bottom outlet will be at the back of the tower.

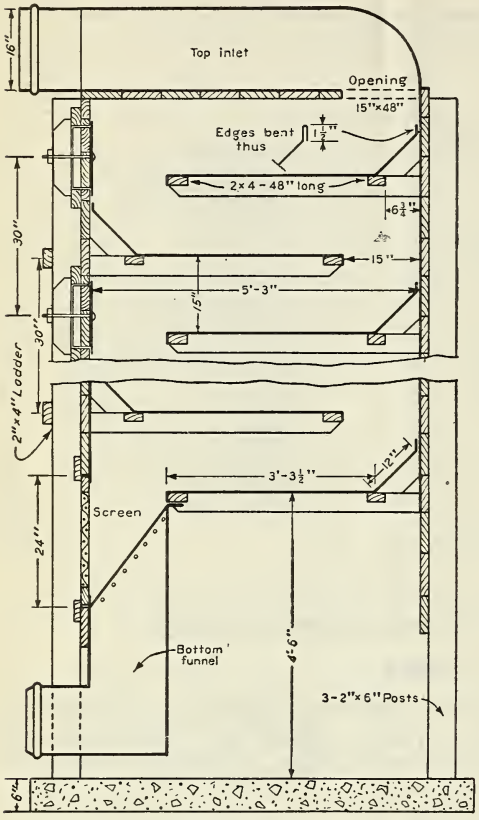

FIGURE 4.—Construction details of drying tower

The heights of towers, including the top inlet, for various numbers of floors, are as follows:

Number of floors	Total height of tower
	Ft. *in.*
13	22 1
14	23 4
15	24 7
16	25 10
17	27 1
18	28 4
19	29 7
20	30 10

The side walls of the tower are lined with flat sheets of No. 28 galvanized iron and the floors are spaced 15 inches apart, as shown in Figure 4. The floors should be of No. 22 galvanized sheet iron or heavier. For the drier foundation a concrete slab, 7 feet long and 5 feet wide, is desirable. Handholes should be placed in the front of the tower opposite alternate floors to permit inspection and easy cleaning. Details of these handholes are shown in Figure 5. A ladder on the front of the tower (figs. 1 and 4) makes it easy to reach any handhole.

The front and back of the tower are usually constructed on the ground, so that the corner posts may be readily assembled from stock lumber and so that the handholes (figs. 4 and 5) for the front of the tower can easily be laid off and cut. The corner posts consist of three 2 by 6 inch pieces nailed together; the front, back, and sides are of 2 by 8 inch boards laid horizontally. When the front and back have been finished and faced with galvanized sheet metal they are placed in a vertical position; then the sides are built up.

The sills and crosspieces for the floors are usually built in as the side walls are erected. This is a very simple method of construction, since planks may be placed on the floor frames to form scaffolding. The floor supports and incline pieces may be either spiked or bolted to the sides and ends of the tower, and the heavy sheet-metal

incline and floor sheets should be carefully nailed to them. The floors are each laid and secured in turn, commencing with the lowest, and a top of 2-inch planking completes the carpentry work on the tower.

All upper edges of the floor sheets and of the metal facing on the handholes should be beaded back into a return bend, having a round, smooth edge so that no cotton will be caught in passing through the drier. No nails smaller than 8-penny should be used in securing the galvanized lining and floor sheets, and where the nails go through the siding they should be clinched.

The top of the tower is then fitted with the No. 22 galvanized top inlet shown in Figures 4 and 6, which forms the hood where the hot air and damp cotton are delivered into the drier. The top inlet is flared out and increased in area to slow down the hot-air currents so that their velocity will be just sufficient to carry the damp cotton from floor to floor, tumbling and drying it as it goes. The hot-air current alone keeps the cotton moving. A 1-inch steam line should be led to the top of the tower for use in case of fire. If the drier tower is exposed to the weather, it will be necessary to insulate and cover this top inlet in order to conserve heat.

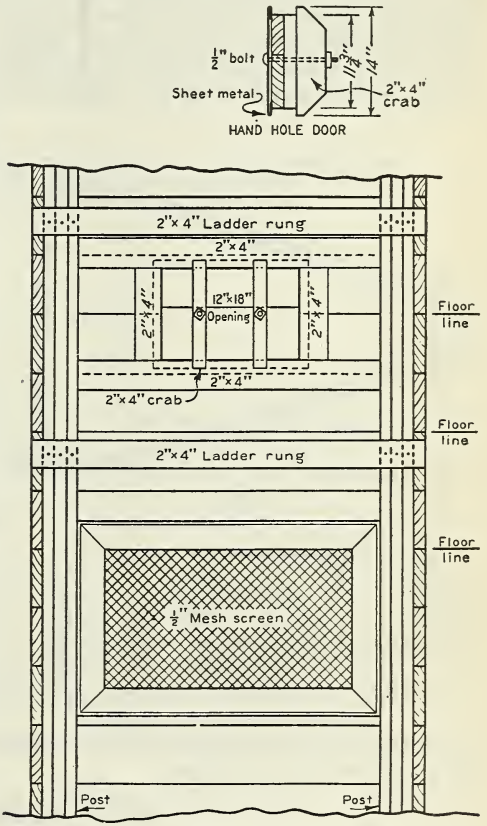

FIGURE 5.—Lower portion of front of tower and handhole door

After the floors have been laid, the bottom funnel (figs. 4 and 7) should be nailed in position. Various shapes of funnels may be used; Figure 6 indicates a side outlet as alternative to the front opening. The diameter may be varied to suit the gin suction but is usually 12½ or 13 inches.

The screen in the opening in the front of the tower (figs. 4 and 5) should be easily removable for access into the bottom funnel. It may be of perforated plate. It acts as an equalizer between the hot-blast fan of the drier and the regular suction fan of the gin, permitting a wide variation in the capacities of the two fans and preventing a bottling or corking action within the drying tower. During the operation of the drier, a great deal of "pin trash" and other dirt is thrown out through this screen.

FEEDING EQUIPMENT

Wet cotton may be taken from the wagon through a special telescope, or through the regular wagon telescope by piping and valves arranged as shown in Figure 3. The latter installation permits one wagon scale to be used for weighing in all cotton.

The drier installation ordinarily requires a separator, an unloading fan, and a drying fan. The separator should be of the vacuum-wheel type. An unloading fan is required in addition to the regular gin fan, in order that the usual overflow telescope may be used for drawing dried cotton to the gin. The fans may be direct-connected, motor-driven outfits or may be operated from a special line shaft. Where motor-driven fans are used, it is customary to place one of the motors so that it will drive both the fan and a small line shaft from which the separator may be operated. The fans and separators should be run at normal ginning speeds.

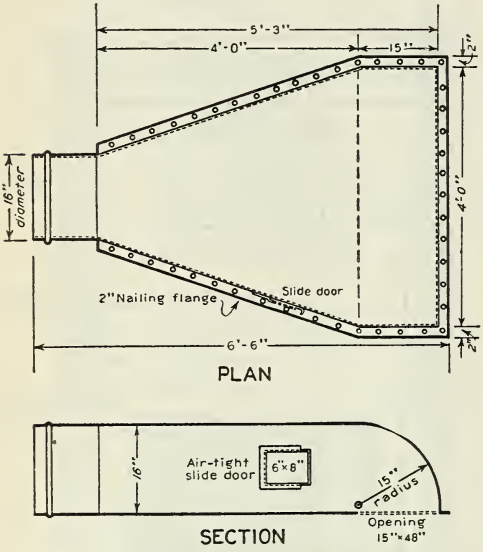

FIGURE 6.—Plan and section of top inlet for tower

DRYING FAN

The drying fan may be arranged to draw the hot air into it as shown in Figures 1 and 2, or to blow through the blast coils as shown in Figure 3. In either case the suction of the fan must be protected with a suitable screen so that lint and dirt will not choke up the steam-heater coils. For a 4-80 outfit, a No. 40 fan operated at 1,750 revolutions per minute is recommended for supplying the hot air to the drier. If motor driven, it should be provided with at least a 20-horsepower motor. A 5-80 gin outfit may require a No. 45 fan.

COTTON PIPING

The hot-blast pipe from the drier fan to the tower must be 16 inches in diameter, to prevent restriction in the volume of hot air. The separator should discharge into the 16-inch hot-blast pipe through a sloping chute, as shown in Figure 1, so that there will be no "back lash" or countercurrents to cause chokage. A suction heel should protrude from this sloping chute about 3 inches into the hot-blast pipe, as this tends to draw the cotton out of the chute and avoids chokage where the cotton enters the pipe.

Both the dried-cotton pipe from the bottom of the tower to the gin overflow floor and the overflow suction pipe should be at least 12½ inches in diameter, as smaller pipes prevent rapid removal of the dried cotton from the tower.

All cotton piping leading to and from the drier should be insulated. Common sheet asbestos will serve this purpose.

SOURCE OF HEAT

A 30-horsepower or larger steam boiler may be used for normal drying work, vertical boilers being preferred. Pressure should be kept at from 50 to 100 pounds gauge, and the boiler should be well covered to obtain economy of fuel. The steam coils for the drier must be placed about 10 feet higher than the water line of the boiler, so that the condensed steam will drain back to the boiler without traps or pumps. A check valve should be put in this return line, and a ½-inch vent valve on each coil so that the heater will not become air bound. Each coil vent may be led through a check valve to a common automatic vent valve, but the vents from the two sections should not be combined without the use of the check valves.

AIR-BLAST HEATER

The steam coils may be homemade, of 16 rows of 1-inch pipe, each row consisting of about 14 pipes 42 inches long, with return bends, or a commercial heater may be used. The fin type of heater is suggested because it is light, is built in a unit with its casing, and needs only a single supply and return connection. A 4-foot, 4-row fin heater 30 inches wide, or its equivalent, should heat 4,000 cubic feet of air per minute to 180° F., which is about the capacity of a No. 40 gin fan.

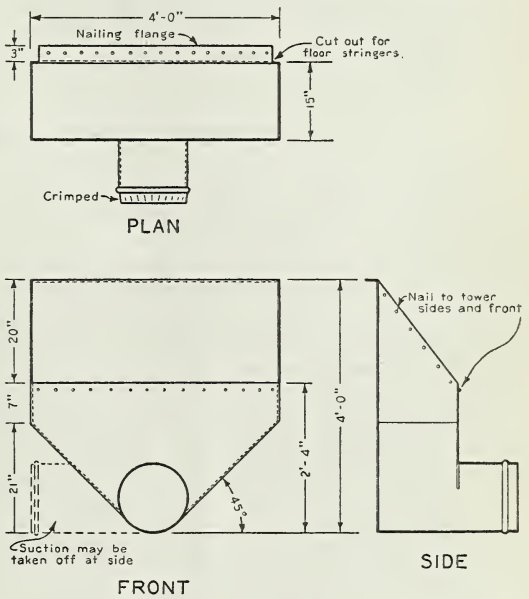

FIGURE 7.—Plan and elevations of bottom funnel

SOURCE OF POWER

Where both unloading and hot-blast fans are motor-driven units, each should be supplied with a 20-horsepower motor, as previously described, but where the entire outfit is operated from a single motor or engine, from 30 to 35 horsepower usually is sufficient to run both the fans and the separator.

OPERATION

Before beginning operation, a test run should be made to determine that a volume of air is blown through the drier sufficient to convey the cotton readily from the separator to the bottom funnel.

Before commencing a day's run, it is advisable to operate the drying fan for at least five minutes, so that the tower will be heated and ready to receive the first load of cotton. During this warming-up of the drier, the gin suction should always be connected in order to warm up all of the piping between the drier and the ginning system.

Variation of the steam pressure between 50 and 100 pounds will not hinder nor appreciably affect the drying operations, therefore it is not necessary to fire the boiler at any set pressure or to insist upon having the highest limits at the coils.

When the ginner has become thoroughly familiar with the operation of the drier, he should install a thermometer in the hot-blast pipe between the fan and the separator chute (fig. 1) so that he may control the temperatures to suit the condition of cotton. It is well to inspect incoming loads of seed cotton and adjust drying temperatures to the individual requirements of each load. This can be easily accomplished with a little practice and will add materially to the economies of drying and to the smoothness of the ginning.

ALTERNATE INSTALLATIONS

One fan could be used both for unloading and for drying, by using the air from the unloading fan for the hot-blast, but this fan would need to be larger than one required for either purpose alone. With this arrangement, the blast-heating coils should be made of smooth 1-inch pipe in an air-tight casing, and should be cleaned daily. Even so, with roughly gathered dirty cotton, the operation might be very unsatisfactory. Using one fan for both unloading and drying would eliminate whatever cleaning effect the unloader might otherwise have.

The regular gin fan, if of sufficient capacity, could be used for drying if the drying tower were built over the gin stand so that the dried cotton would drop by gravity into the cleaner and distributor. Such construction would cause the drying tower to protrude through the roof of the ginnery. The same fan could not be used both to drive the hot blast into the tower and to suck the dried cotton out of the tower.

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